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1 COMMUNICATING SCRIPTS IN A DATA
2 SERVICE CHANNEL OF A VIDEO SIGNAL

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5
6 TECHNICAL FIELD

7 The invention relates generally to supplementing
8 broadcast television programming with information of
9 interest to broadcast viewers.

10
11 BACKGROUND OF THE INVENTION

12 The Internet is a worldwide collection of networks and
13 gateways. The Internet includes a backbone of high-speed
14 data communication lines between major nodes, consisting of
15 thousands of commercial, government, educational, and other
16 computer systems, that route data and messages. The World
17 Wide Web (the Web) is a collection of formatted hypertext
18 pages located on numerous computer systems around the world
19 that are logically connected by the Internet. The Web has
20 become a valuable resource for information relating many
21 subjects.

22 Web browsers, software providing user interfaces to
23 the Web, allow individuals to access Internet content from
24 personal computers. Internet terminals, such as those
25 pioneered by WebTV Networks, Inc., the assignee of the
26 present invention, have made the Web accessible to an even
27 larger segment of the population by providing Web access
28 without a personal computer. Internet terminals (also
29 commonly referred to as set-top boxes) provide Web access
30 using an ordinary television (TV) set as a display and a
31 remote control or wireless keyboard for user input.

1 Figure 1 illustrates a basic configuration of an
2 Internet system and broadcast television network 100.
3 Network 100 includes a pair of clients 110 and a
4 receiver/client 112. Receiver/client 112 is so named
5 because it operates both as a television receiver and as an
6 Internet client. Hereafter, receiver/client 112 is referred
7 to as receiver 112 for simplicity.

8 Clients 110 and receiver 112 are coupled to a modem
9 pool 120 via direct-dial, bi-directional data connections
10 130, which may be telephone (POTS, i.e., "plain old
11 telephone service"), cable, satellite forward channels,
12 ISDN (Integrated Services Digital Network), or any other
13 similar type of connection. Modem pool 120 is typically
14 coupled to a number of remote servers 140 via a network
15 infrastructure, such as the Internet 160. An additional
16 server 150 specifically supports receiver 112.

17 Clients 110 and receiver 112 communicate bi-
18 directionally with servers 140 and 150 through modem pool
19 120 and the Internet 160. Modem pool 120 is typical of
20 those found today throughout the world providing access to
21 the Internet and private networks. In addition to
22 communicating with servers 140 and 150, receiver 112
23 receives broadcast data and video from a broadcast
24 television network 170 via, e.g., antennas 175 or a cable
25 network (not shown).

26 Figure 2 illustrates an embodiment of receiver 112.
27 Receiver 112 includes set-top box 200, an ordinary analog
28 television set 210, and a remote control 220. Set-top box
29 200 may be integrated with television set 210. Television
30 set 210 displays video data, including a graphical user
31 interface, conveyed from set-top box 200 by a video link

1 230. Video link 230 is an RF (radio frequency), S-video,
2 composite video, or other video link.

3 Set-top box 200 includes hardware and software for
4 receiving and decoding a broadcast video signal 240, such
5 as an NTSC, PAL, SECAM, or other TV system video signal,
6 and for providing video data to the television set via
7 video link 230. Set-top box 200 also includes hardware
8 and/or software for providing a user with a graphical user
9 interface 250 capable of displaying Web pages (e.g., HTML
10 or XML pages) and broadcast video. User interface 250 can
11 notify the user of the presence of encoded data embedded in
12 the video signal. The notification may be audible, visual,
13 or a combination of the two. For example, user interface
14 250 might temporarily display an icon in a portion of the
15 screen.

16 Set-top box 200 may include both a standard modem and
17 an ISDN modem, such that the communication link between
18 set-top box 200 and server 150 (Figure 1) can be either a
19 telephone (POTS) connection 260 or an ISDN connection 270.
20 Set-top box 200 receives power through a power line 280.

21 A user operates remote control 220 to control set-top
22 box 200 in browsing the Web, sending e-mail, and performing
23 other Internet-related functions. Set-top box 200 receives
24 commands from remote control 220 via an infrared (IR)
25 communication link 290. A keyboard (not shown) may also be
26 included.

27

28 EXEMPLARY RECEIVER SYSTEM ARCHITECTURE

29 Figure 3 is a block diagram illustrating internal
30 features of set-top box 200. Set-top box 200 is controlled
31 by a processing unit, such as central processing unit (CPU)
32 300, which is coupled to an Application-Specific Integrated

1 Circuit (ASIC) 310. ASIC 310 contains circuitry that
2 implements certain features provided by set-top box 200.
3 ASIC 310 is coupled to an audio digital-to-analog converter
4 (DAC) 320 that provides audio output to television 210.
5 ASIC 310 is also coupled to a video encoder 330 that
6 provides video output to television 210. An IR interface
7 335 detects IR signals transmitted by remote control 220
8 and, in response, provides corresponding electrical signals
9 to ASIC 310. A standard telephone modem 340 and/or an ISDN
10 modem 342 are coupled to ASIC 310 to provide connections
11 260 and 270, respectively, to the Internet.

12 A television (TV) interface 345 conveys broadcast
13 video signals to ASIC 310, allowing video data carried in
14 broadcast video signal 240 to be presented to a viewer on
15 TV 210. TV interface 345 also extracts other data that may
16 be embedded in the video signal. The data so extracted, or
17 a portion thereof, may be displayed concurrently with a
18 television program. For example, analog broadcast signals
19 typically include a portion known as the vertical blanking
20 interval (VBI) that is used to transmit, among other
21 things, closed captioning information. Data inserted into
22 the VBI are extracted by TV interface 345 and displayed on
23 the TV 210.

24 Set-top box 200 also includes read-only Memory (ROM)
25 350, a random-access memory 355, and a mass storage device
26 360. ROM 350 stores program code for application software
27 executed by CPU 300. RAM 355 serves as temporary storage
28 for CPU 300 as CPU 300 executes instructions. Mass storage
29 device 360 may be used to input software or data to set-top
30 box 200 or to store information received either from
31 network connections or from broadcast signals. Mass storage

1 device 360 includes any suitable data storage medium, such
2 as magnetic tapes, magnetic disks, and optical disks.

3 A number of companies support appliances similar to
4 receiver 112 to enhance broadcast television with Internet
5 content. For example, Intel® Intericast® technology offers a
6 VBI inserter that enables content creators to insert Web
7 pages into the VBI of a broadcast signal. Dedicated
8 receiver platforms then sample the VBI of the broadcast
9 signal to obtain and display the Web pages. Unfortunately,
10 the bandwidth of the VBI is limited, so content-rich Web
11 pages can be slow to broadcast. As a result, content
12 updates can be undesirably slow.

13 WebTV® for Windows® is similar to Intericast®
14 technology, but has the ability to update information
15 presented by a broadcast Web page by broadcasting a script
16 capable of interacting with the Web page. Targeted
17 receivers receive the script and store the script in memory
18 for later use. The content creator then causes the script
19 to be executed by broadcasting a message that identifies
20 the stored script and the Web page with which the script is
21 to interact.

22 The broadcasting techniques of WebTV® for Windows®
23 work well to update information presented by Web pages.
24 However, the processes of downloading, storing, and later
25 triggering a script are collectively complex and time
26 consuming. Further, such scripts are not themselves
27 incorporated into the language defining Web pages, but
28 instead remain separate from the Web pages with which they
29 interact. Broadcast scripts can therefore alter the image
30 presented by a Web page but are limited in their ability of
31 change the functionality of the page.

32

1 SUMMARY OF THE INVENTION

2 The present invention is directed to methods and
3 apparatus for enhancing an information resource, such as a
4 Web page, simultaneously residing in memory on a number of
5 remote receivers.

6 Web pages are authored using HTML, for "Hypertext
7 Markup Language." HTML uses tags to mark elements, such as
8 text and graphics, in a document to indicate how web
9 browsers should display these elements to the user and
10 respond to user actions. HTML pages may also include one or
11 more scripts that allow HTML page authors to dynamically
12 control the interaction and behavior of their pages.

13 For purposes of the present invention, the HTML tags
14 and scripts of a given Web page define the "context" of
15 that page. This context is distinct from the visual image
16 provided by a page, which can vary between two identical
17 HTML pages depending upon a receiver's interpretation of
18 the page and upon the resources referred to by the page.
19 For example, a tag within an HTML page may refer to an
20 image that is independent of the page: altering the image
21 will change the visual representation of the page without
22 changing the context of the page. The present invention
23 allows content creators to alter both the visual
24 representation of a given page and the context of the page
25 by allowing content creators to broadcast scripts directed
26 to specified Web pages.

27 In accordance with the invention, a content creator,
28 (e.g., a program producer, broadcaster, affiliate, cable
29 company, or satellite provider), embeds a trigger in a data
30 service channel of a broadcast video signal. The embedded
31 trigger includes a resource identifier unique to a targeted
32 information resource and a script capable of modifying the

1 information resource. The script might be a script or a
2 segment of a script written in a scripting language, such
3 as JavaScript™, ECMAScript, JScript™, or VBScript. Such
4 scripts allow content creators to provide interaction
5 between an information resource and a viewer, to control
6 the receiver, and to dynamically create HTML content.

7 The script-bearing triggers (hereafter "script
8 triggers") are broadcast in the data service channel of a
9 broadcast video signal. Each receiver adapted to interpret
10 trigger content begins with an information resource, such
11 as a Web page, resident in memory. The receiver can obtain
12 such a resource via the Internet, broadcast video, or from
13 local storage. The receivers, tuned into the appropriate
14 broadcast signal, monitor the data service channel of that
15 signal for triggers that are directed to the information
16 resource resident on the receiver. Upon receipt of such a
17 script trigger, the receiver executes the script contained
18 within the trigger to alter the information resource and/or
19 displayed video defined by the resource.

20 Other features of the present invention will be
21 apparent from the accompanying drawings and from the
22 detailed description that follows.

23 24 BRIEF DESCRIPTION OF THE DRAWINGS

25 Figure 1 (prior art) illustrates a basic configuration
26 of an Internet system network 100.

27 Figure 2 (prior art) illustrates an embodiment of a
28 receiver/client 112 for displaying broadcast television and
29 Internet content.

30 Figure 3 (prior art) is a block diagram illustrating
31 internal features of a set-top box 200.

1 Figure 4 illustrates a communication system 400,
2 including five content receivers 405-409 configured in
3 accordance with the invention.

4 Figure 5 is a flowchart depicting a method for
5 synchronizing broadcast video data with information
6 resources residing in memory on a number of remote
7 receivers.

8 Figure 6 is a flowchart depicting a method performed
9 by a receiver configured in accordance with the invention
10 to respond to script triggers.

11

12 DETAILED DESCRIPTION OF THE INVENTION

13 Figure 4 illustrates a communication system 400,
14 including five content receivers 405-409 configured in
15 accordance with the invention. Communication system 400
16 also includes two content sources, a web server 410 and a
17 television broadcaster 415, and a conventional television
18 417. Web server 410 communicates with each of receivers
19 405-407 via the Internet 420, while broadcaster 415
20 communicates to each of receivers 405-409 and television
21 417 via a broadcast signal 421. Internet 420 is understood
22 to include all modems, lines, and other intervening
23 components required to communicate between server 410 and
24 receivers 405-407.

25 Each of receivers 405-409 is configured to display Web
26 pages, broadcast television, or both. Web pages are
27 typically downloaded over the Internet, but may also be
28 received from a broadcast television signal or retrieved
29 from a local memory source, such as a disk drive. In each
30 case, however, the Web pages are stored locally on the
31 receivers.

1 ~~123~~
2 ~~41~~ Receiver 405 displays a "Sports Page" Web page 422
3 along with a broadcast baseball game 424. In accordance
4 with the invention, a portion of web page 422, game score
5 426, for example, can be updated in response to a script
6 received from broadcaster 415. Sports page 422 can thus be
7 synchronized with baseball game 424 without connecting to
8 the Internet. Updating just a portion of sports page 422
9 advantageously requires less bandwidth than updating the
entire page.

10 Receiver 406 illustrates another advantage of this
11 embodiment. Receiver 406 includes broadcast video 426 and a
12 "Local Forecast" page 428. Web page 428 includes a form
13 field 430 inviting a user to enter a local zip code. In
14 accordance with the illustrated embodiment, broadcaster 415
15 can provide periodic script triggers including scripts that
16 interact with the zip code to provide weather updates
17 specific to the selected zip code. Such updates might
18 include textual weather information or graphics, such as
19 weather symbol 432. A number of scripting languages support
20 this type of interaction between a page and the user.
21 Exemplary scripting languages include JavaScript,
22 ECMAScript, JScript™, and VBScript. Alternatively,
23 broadcaster 415 can modify page 428 to include additional
24 functionality by broadcasting a script for incorporation
25 into page 428.

26 The following text is HTML code defining Local
27 Forecast page 428. The HTML code includes a script entitled
28 "Zip Code Weather" at <<http://www.weatherzip.com/page.html>>
29 for accepting a zip code and responding to script triggers
30 directed to particular zip codes. The script is written
31 using the ECMAScript scripting language.

32

552040" 58528250

```

1  <HTML>
2  <HEAD><TITLE>Zip Code Weather</TITLE></HEAD>
3  <BODY>
4
5  <SCRIPT>
6  function newWeather(zip, weather) {
7      if (zip == zipForm.userZip)
8          weatherPic.src = weather + ".gif";
9  }
10 </SCRIPT>
11
12 <P>Your Zip: <FORM NAME=zipForm><INPUT TYPE="text"
13 NAME="userZip"></FORM></P>
14
15 <P>Today's Weather: <IMG NAME=weatherPic
16 SRC="sunny.gif"></P>
17
18 </BODY>
19 </HTML>

```

The foregoing weather script can be included in an original broadcast of page 428 or can be appended to page 428 using a script trigger that includes the requisite script (i.e., the portion of the foregoing HTML code between and including the <SCRIPT LANGUAGE> and </SCRIPT> tags). In either case, once page 428 includes the script a content creator can update page 428 to include a local forecast for zip code 98502 by broadcasting the following exemplary script trigger:

```

<http://www.weatherzip.com/page.html>[script:newWeather
("94114","snow)][464c]

```

1
2 The "URL" field (separated by angle brackets) identifies
3 the target page, while the script field identifies the
4 script and related arguments to be passed to the target
5 page. The final field includes a checksum value for error
6 detection. The specifics of script-trigger syntax are
7 described below.

8 Receivers 407 and 408 illustrate yet another advantage
9 of this embodiment. Receivers 407 and 408 each illustrate
10 an example in which a user simultaneously views broadcast
11 baseball game 424 and a "Business News" page 434. Business
12 News page 434 might be in information resource associated
13 with a particular business channel or program that
14 periodically broadcasts script triggers to news page 434
15 that provide timely stock prices for a series of companies,
16 each company identified by a symbol.

17 Business News page 434 includes a form field 436 that
18 invites a user to enter a symbol corresponding to a public
19 company. In the depicted example, receiver 407 includes the
20 symbol MSFT in form field 436, while receiver 408 includes
21 the symbol BA. Receiver 407 then receives and displays the
22 MSFT stock price upon receipt of a script trigger directed
23 to page 434 and specifying the symbol MSFT; similarly,
24 receiver 408 receives and displays the BA stock price upon
25 receipt of a script trigger directed to page 434 and
26 specifying the symbol BA. Thus, instead of requiring a
27 broadcaster to display all stock prices, individual users
28 can adapt their environments to suit their own tastes.

29 A displayed television channel need not be related to
30 a displayed web page. For example, receiver 407 can tune
31 into two channels simultaneously so that a user can watch a
32 television program on one channel (e.g., baseball game 424)

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1 while receiver 407 monitors the second channel for
 2 enhancements to business page 434. Tuners capable of
 3 monitoring two or more channels simultaneously are well
 4 known in the art.

5 In each of the foregoing examples, the receiver
 6 responded to some input from the user. The invention is
 7 not, however, limited to interactive applications. For
 8 example, receiver 409 is shown simultaneously displaying a
 9 television show 438 and an airline page 440. Broadcaster
 10 415 can cause airline page 440 to be updated by
 11 transmitting a script trigger to page 440 without requiring
 12 any user interaction. In the example, airline page 440
 13 includes a text field 442 advising the viewer that San
 14 Francisco International Airport (SFO) is closed due to fog.

15 16 SCRIPT TRIGGERS

17 Having described an exemplary environment in which
 18 script triggers may be employed, script-trigger syntax and
 19 usage will now be discussed. Trigger messages, or
 20 "triggers," are instructions broadcast to receivers of
 21 broadcast video. Such triggers generally instruct receivers
 22 to take a specific action to synchronize the content of a
 23 Web page with a broadcast television program. For purposes
 24 of the present invention, "script triggers" are triggers
 25 that include a script or a portion of a script capable of
 26 enhancing a specified information resource.

27 *145*
A2 Script triggers include a resource locator, a script
 28 or a portion of a script, and may also include a human-
 29 readable name and an expiration time. The resource locator
 30 addresses a particular resource to be enhanced by the
 31 trigger. In the example of receiver 405 of Figure 4, script

12
1 triggers intended to enhance sports page 424 would include
2 a resource locator specific to sports page 422.

3 A resource locator commonly associated with Web
4 content is the Uniform Resource Locator (URL). A URL is a
5 compact string representation of a location used to
6 identify an abstract or physical resource on the Internet.
7 Of course, alternative means of uniquely identifying
8 content may be employed. For example, it is appreciated
9 that keys (e.g., database indices), network addresses
10 (e.g., IP addresses), and other identification mechanisms,
11 alone or in combination, may be employed to uniquely
12 identify a selected resource. Therefore, while the term URL
13 refers to a specific type of content identifier used in
14 connection with the Web, the term uniform resource
15 identifier is used herein to refer to content/resource
16 identification mechanisms generally.

18 SCRIPT-TRIGGER SYNTAX

19 Script triggers may be transmitted in the VBI of an
20 analog broadcast video signal. The text service channels of
21 line 21 of the VBI provide a robust communication medium,
22 albeit at relatively low bandwidth. In some embodiments of
23 the invention, triggers are text based, and their syntax
24 follows a basic format that complies with the Electronic
25 Industries Association EIA-746A, "Transport of Internet
26 Uniform Resource Locator (URL) Information Using Text-2 (T-
27 2) Service" (September 1998), which is incorporated herein
28 by reference. EIA-746A defines the formatting necessary to
29 transmit Internet URLs using the vertical-blanking interval
30 of a broadcast television signal, and is incorporated
31 herein by reference.

1 In one embodiment that complies with EIA-746A, each
2 script trigger includes a URL followed by zero or more
3 attribute/value pairs and an optional checksum, as follows:

4
5 `<url> [attr1:val1] [attr2:val2] ... [attrn:valn] [checksum]`

6
7 The URL is enclosed in angle brackets. For example, the URL
8 "http://sports.com/scores.html" might identify sports page
9 422, indicating that a given trigger is intended to update
10 page 422.

11 The attribute/value pairs can be selected to achieve
12 some desired interaction with the specified resource. A
13 script attribute, formatted as [script:string], provides a
14 script or script fragment to execute within the context of
15 the page identified by the URL. For example,
16 [script:report_stock("MSFT", "\$92/SH")] might be directed
17 to business page 434 to update the stock price displayed to
18 those users specifying MSFT, or to introduce some new
19 functionality to page 434 by amending page 434 to include
20 an additional script. The "string" value is written as an
21 ECMAScript fragment in one embodiment, but can be written
22 in any number of scripting languages.

23 A "name" attribute, provides the user with readable
24 text. For example "[name:SFO CLOSED DUE TO FOG]" could be
25 used to alert a users as described above in connection with
26 receiver 409. The "name" attribute and the "script"
27 attribute can each provide text messages such as that
28 illustrated on airline page 440. The script attribute is
29 more powerful, however, because scripts can be used to
30 modify the context of page 440. For example, scripts can be
31 broadcast to receiver 406 to incorporate field 430 and the
32 script that provides page 428 with the ability to provide

1 local weather information. Script attributes allow content
2 creators to improve their Web pages without broadcasting
3 complete new pages.

4 A time stamp indicating a time after which the trigger
5 expires follows an "expires" attribute. One embodiment
6 employs the form *yyyymmddThhmmss*, where the capital letter
7 "T" separates the date from the time. The *time* string may
8 be shortened by reducing the resolution. For example
9 *yyyymmddThhmm* (no seconds specified) is valid, as is simply
10 *yyyymmdd* (no time specified at all). When no time is
11 specified, expiration is at the beginning of the specified
12 day. The expires attribute can be abbreviated as the single
13 letter "e" (e.g. [e:19971223]). The "expires" attribute
14 ensures that information contained in triggers is timely.
15 Without this attribute, a rebroadcast of a show might
16 provide an incorrect update, for example an erroneous stock
17 quote.

18 A checksum may be appended to the end of the logical
19 address link to detect data corruption that may occur
20 during receipt or transmission of a trigger. A two-byte
21 hexadecimal checksum is employed such as a checksum that
22 would be produced by the standard TCP/IP checksum algorithm
23 described in Request For Comments (RFC) 719, "Internet
24 Protocol," September 1981, which is incorporated herein by
25 reference. According to one embodiment, the checksum is
26 computed by pairing adjacent characters in the string
27 (starting with the first delimiter) to form 16-bit
28 integers. If there is an odd number of characters, the
29 final character is paired with a byte value of zero. The
30 checksum is computed such that the one's complement sum of
31 all of the 16-bit integers plus the checksum equals the 16-
32 bit integer with all 1 bits.

00000000000000000000000000000000

1 For a detailed discussion of the above-described
2 trigger syntax, see the Advanced Television Enhancement
3 Forum Specification (ATVEF), Versions 1.1 revision 26,
4 (2/2/99), which is incorporated herein by reference.

6 TRIGGER RECEIVER OBJECTS

7 Some embodiments of the invention require that
8 intended target resources include a trigger receiver
9 object. The trigger receiver object, implemented by the
10 receiver, processes triggers in the context of the resource
11 containing the trigger object. See the above-incorporated
12 ATVEF specification for a detailed discussion of trigger
13 objects, including their syntax and use in accordance with
14 an embodiment of the invention.

16 BROADCAST METHOD

17 Figure 5 is a flowchart depicting a method employed by
18 a content creator (e.g., a program producer, broadcaster,
19 affiliate, cable company or satellite provider) to
20 synchronize broadcast video data with information resources
21 stored locally on a number of remote receivers. The
22 information resources are, in one embodiment, Web pages
23 (e.g., HTML or XML pages). Information resources are
24 typically displayed, but this is not necessarily the case.
25 For example, a content creator might want to update locally
26 stored pages while the user is watching another channel, or
27 even while the video display is turned off. A user would
28 thus be presented with timely information each time the
29 user selected a particular information resource without
30 having to connect to the Internet or wait for the selected
31 channel to broadcast the latest content.

1 In accordance with the invention, the content creator
2 first creates a script trigger (step 500) using, for
3 example, the syntax described above. Next, the broadcaster
4 embeds the script trigger into a data service channel of
5 some broadcast signal (step 510). In one embodiment, the
6 broadcast video signal is a National Television Standards
7 Committee (NTSC) video signal including a vertical blanking
8 interval (VBI), and the data service channel is selected
9 from a captioning service channel of a text service
10 channel. The video signal may also be Phase Alternate Lines
11 (PAL), Sequential Couleur Avec Memoire (SECAM), High
12 Definition Television (HDTV), or a digital video signal
13 such as a Digital Video Broadcasting (DVB) signal or an
14 Advanced Television Systems Committee (ATSC) signal.

15 Where the broadcast video signal is NTSC video signal,
16 the trigger can be imbedded into line 21 of the vertical
17 blanking interval (VBI). The protocols for broadcasting
18 data in line 21 of the VBI call for relatively robust, low-
19 speed communication. Higher bandwidth can be obtained using
20 other lines of the VBI. Finally, the broadcaster broadcasts
21 the script trigger (step 520).

22 The upstream video may contain previously encoded data
23 in line 21 of the VBI. Each content creator is therefore a
24 potential re-encoding point along the broadcast
25 distribution path. At any re-encoding point, the existing
26 data may be extracted from the captioning data channel or
27 the text service channel of the video signal. Subject to
28 certain bandwidth limitations, the content creator may then
29 embed one or more script triggers into a captioning or text
30 service packet of the video signal. The video signal may
31 then be transmitted to the next downstream receiving
32 device(s). This process may be repeated during video signal

1 processing at each point along the video signal
2 distribution path.

3 The foregoing broadcast methods are embodied in
4 machine-executable instructions, which can be used to cause
5 a general-purpose or special-purpose processor programmed
6 with the instructions to perform the steps. Alternatively,
7 the steps might be performed by specific hardware
8 components that contain hardwired logic for performing the
9 steps, or by any combination of programmed computer
10 components and dedicated hardware.

11

12 RECEIVER METHOD

13 Figure 6 is a flowchart depicting a method performed
14 by a receiver configured in accordance with the invention
15 to respond to script triggers. First, the receiver stores
16 an information resource, such as a web page, locally in the
17 receiver (step 600). The information resource can be stored
18 in video memory for immediate display or elsewhere in
19 memory, for example on a magnetic hard disk. The receiver
20 can obtain the resource from any number of information
21 sources, such as from a server on the Internet, from a
22 broadcast signal, or from a local memory device, such as a
23 hard-disk drive or CD ROM drive.

24 Next, in step 610, the receiver monitors one or more
25 broadcast channels for valid script triggers directed to
26 the stored information resource. For example, where the
27 information resource is identified by a URL, the receiver
28 monitors broadcast video for script triggers that include a
29 URL matching that of the information resource. A valid
30 script trigger is one that is encoded in a predetermined
31 syntax, such as the syntax described earlier, and whose
32 resource locator and attribute/value pairs are not

1 corrupted, as determined by a comparison of a checksum
2 generated by the receiving device to the checksum
3 accompanying the script trigger. The receiver ignores
4 invalid script triggers.

5 Upon receipt of a valid script trigger matching the
6 information resource (step 620), the receiver determines
7 whether the resource locator associated with the script
8 trigger matches that of the information resource (decision
9 630). If not, the receiver disregards the script trigger
10 (step 640) and continues monitoring the broadcast channel.
11 If, on the other hand, the resource locator associated with
12 the script trigger matches that of the receiver, then the
13 information resource executes the script or script fragment
14 within the script trigger (step 650) and continues
15 monitoring the broadcast channel (step 610).

16 The foregoing receiver methods are embodied in
17 machine-executable instructions, which can be used to cause
18 a general-purpose or special-purpose processor programmed
19 with the instructions to perform the steps. Alternatively,
20 the steps might be performed by specific hardware
21 components that contain hardwired logic for performing the
22 steps, or by any combination of programmed computer
23 components and dedicated hardware.

24 25 REFERENCES

26 The following references provide additional background
27 information relating to the present invention, and are
28 incorporated herein by reference.

- 29 1. W3C, "HTML 4.0 Specification," chapters 1-18 (April
30 1998), identified as page "[http://www.w3.org/TR/REC-](http://www.w3.org/TR/REC-html40/)
31 [html40/](http://www.w3.org/TR/REC-html40/)".

- 1 2. ECMA - European association for standardizing
2 information and communication systems, "Standard ECMA-
3 262, 2nd Edition" (August 1998), the ECMAScript
4 Language Specification.
- 5 3. W3C, "Document Object Model (DOM) Level 1
6 Specification" (October 1998), identified as page
7 [http://www.w3.org/TR/1998/REC-DOM-Level-1-](http://www.w3.org/TR/1998/REC-DOM-Level-1-19981001/DOM.txt)
8 [19981001/DOM.txt](http://www.w3.org/TR/1998/REC-DOM-Level-1-19981001/DOM.txt).
- 9 4. R. Panabaker, S. Wegerif, and D. Zigmond, "The
10 Transmission of IP Over the Vertical Blanking Interval
11 of a Television Signal," (February 1999), identified
12 as page "[http://www.ietf.org/internet-drafts/draft-](http://www.ietf.org/internet-drafts/draft-ietf-ipvbi-nabts-02.txt)
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27 While the present invention has been described in
28 connection with specific embodiments, variations of these
29 embodiments will be apparent. For example, while described
30 in connection with video signals, the invention is equally
31 applicable to non-video broadcast applications like digital
32 radio.

- 1 Therefore, the spirit and scope of the appended claims
- 2 should not be limited to the foregoing description.

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